

WHAT IS CLAIMED IS:

1. A perpendicular magnetic recording medium comprising:

a nonmagnetic substrate;

a first under layer formed on the nonmagnetic substrate and containing iron as a main component;

a second under layer formed on the first under layer and containing mainly ruthenium; and

a magnetic recording layer formed on the second under layer and containing mainly cobalt.

2. The perpendicular magnetic recording medium according to claim 1, wherein said first under layer further contains an auxiliary component selected from the group consisting of a combination of aluminum and silicon, a combination of tantalum and carbon, a combination of zirconium and nitrogen, and cobalt.

3. The perpendicular magnetic recording medium according to claim 1, wherein said magnetic recording layer further contains at least one of platinum and chromium.

4. The perpendicular magnetic recording medium according to claim 1, wherein said magnetic recording layer further contains platinum and oxygen.

5. The perpendicular magnetic recording medium according to claim 1, wherein said magnetic recording layer has a multi-layered structure prepared by alternately laminating a ferromagnetic layer containing

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cobalt and a nonmagnetic layer mainly containing one element selected from the group consisting of ruthenium, palladium and platinum.

5 6. The perpendicular magnetic recording medium according to claim 1, further comprising a soft magnetic layer formed between said nonmagnetic substrate and said first under layer.

10 7. The perpendicular magnetic recording medium according to claim 6, wherein said soft magnetic layer contains an alloy selected from the group consisting of an iron-aluminum-silicon series alloy, an iron-tantalum-carbon series alloy, an iron-zirconium-nitrogen series alloy, cobalt-zirconium-nitrogen series alloy, and an iron-cobalt series alloy.

15 8. A perpendicular magnetic recording medium comprising:

a nonmagnetic substrate;  
a first under layer formed on the nonmagnetic substrate and containing cobalt;  
20 a second under layer formed on the first under layer and containing mainly ruthenium; and  
a magnetic recording layer formed on the second under layer and containing cobalt as a main component.

25 9. The perpendicular magnetic recording medium according to claim 8, wherein said first under layer further contains at least one auxiliary component is

one of a combination of zirconium and niobium and chromium.

5 10. The perpendicular magnetic recording medium according to claim 8, wherein said first under layer does not exhibit ferromagnetism.

11. The perpendicular magnetic recording medium according to claim 8, wherein said magnetic recording layer further contains at least one of platinum and chromium.

10 12. The perpendicular magnetic recording medium according to claim 8, wherein said magnetic recording layer further contains platinum and oxygen.

15 13. The perpendicular magnetic recording medium according to claim 8, wherein said magnetic recording layer has a multi-layered structure prepared by alternately forming a ferromagnetic layer containing cobalt and a nonmagnetic layer containing mainly one of ruthenium, palladium and platinum.

20 14. The perpendicular magnetic recording medium according to claim 8, further comprising a soft magnetic layer interposed between said nonmagnetic substrate and said first layer.

25 15. The perpendicular magnetic recording medium according to claim 14, wherein said soft magnetic layer contains an alloy selected from the group consisting of an iron-aluminum-silicon series alloy, an iron-tantalum-carbon series alloy,

an iron-zirconium-nitrogen series alloy and an iron-cobalt series alloy.

16. A perpendicular magnetic recording medium comprising:

5 a nonmagnetic substrate;

a first under layer formed on the nonmagnetic substrate and containing mainly ruthenium;

a second under layer formed on the first under layer and containing mainly cobalt; and

10 a magnetic recording layer formed on the second under layer and containing mainly cobalt.

17. The perpendicular magnetic recording medium according to claim 16, wherein said second under layer further contains chromium.

15 18. The perpendicular magnetic recording medium according to claim 17, wherein said second under layer does not exhibit a ferromagnetism.

19. The perpendicular magnetic recording medium according to claim 16, wherein said magnetic recording layer further contains at least one of platinum and chromium.

20 20. The perpendicular magnetic recording medium according to claim 19, wherein said magnetic recording layer further contains platinum and oxygen.

25 21. The perpendicular magnetic recording medium according to claim 16, wherein said magnetic recording layer has a multi-layered structure prepared by

alternately forming a ferromagnetic layer containing cobalt and a nonmagnetic layer containing mainly one of ruthenium, palladium and platinum.

22. The perpendicular magnetic recording medium according to claim 16, further comprising a soft magnetic layer interposed between said nonmagnetic substrate and said first under layer.

23. The perpendicular magnetic recording medium according to claim 16, wherein said soft magnetic layer contains an alloy selected from the group consisting of an iron-aluminum-silicon series alloy, an iron-tantalum-carbon series alloy, an iron-zirconium-nitrogen series alloy, and an iron-cobalt series alloy.

24. A perpendicular magnetic recording medium comprising;

a nonmagnetic substrate;

a first under layer formed on the nonmagnetic substrate and containing titanium;

a second under layer formed on the first under layer and containing mainly ruthenium; and

a magnetic recording layer formed on the second under layer and containing mainly cobalt.

25. The perpendicular magnetic recording medium according to claim 24, wherein said first under layer is formed of a material selected from the group consisting of a nitride, a carbide and oxide of

titanium, a titanium chromium alloy, and a substantially elemental titanium.

26. The perpendicular magnetic recording medium according to claim 25, wherein said first under layer is formed of a material selected from the group consisting of a nitride of titanium a titanium chromium alloy, and a substantially elemental titanium.

27. The perpendicular magnetic recording medium according to claim 24, wherein said magnetic recording layer further contains at least one element selected from the group consisting of platinum and chromium.

28. The perpendicular magnetic recording medium according to claim 24, wherein said magnetic recording layer further contains platinum and oxygen.

29. The perpendicular magnetic recording medium according to claim 24, wherein said magnetic recording layer has a multi-layered structure prepared by alternately forming a ferromagnetic layer containing cobalt and a nonmagnetic layer containing one element selected from the group consisting of ruthenium, palladium and platinum.

30. The perpendicular magnetic recording medium according to claim 24, further comprising a soft magnetic layer interposed between said nonmagnetic substrate and said first under layer.

31. The perpendicular magnetic recording medium according to claim 30, wherein said soft magnetic

layer contains an alloy selected from the group consisting of an iron-aluminum-silicon series alloy, an iron-tantalum-carbon series alloy, an iron-zirconium-nitrogen series alloy, a cobalt-zirconium-niobium series alloy, and an iron-cobalt series alloy.

32. A perpendicular magnetic recording medium comprising:

a nonmagnetic substrate;

a soft magnetic layer formed on the nonmagnetic substrate;

a first under layer formed on the soft magnetic layer and containing as a main component at least one of vanadium and chromium;

a second under layer formed on the first under layer and containing mainly ruthenium; and

a magnetic recording layer formed on the second under layer and containing mainly cobalt.

33. The perpendicular magnetic recording medium according to claim 32, wherein said magnetic recording layer further contains at least one of platinum and chromium.

34. The perpendicular magnetic recording medium according to claim 32, wherein said magnetic recording layer further contains platinum and oxygen.

35. The perpendicular magnetic recording medium according to claim 32, wherein said magnetic recording

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layer has a multi-layered structure prepared by alternately forming a ferromagnetic layer containing cobalt and a nonmagnetic layer containing mainly one of ruthenium, palladium and platinum.

5 36. The perpendicular magnetic recording medium according to claim 32, wherein said soft magnetic layer contains an alloy selected from the group consisting of an iron-aluminum-silicon series alloy, an iron-tantalum-carbon series alloy,  
10 an iron-zirconium-nitrogen series alloy cobalt zirconium-niobium series alloy, and an iron-cobalt series alloy.

37. A perpendicular magnetic recording medium, comprising:

15 a nonmagnetic substrate; and  
a magnetic recording layer formed on the nonmagnetic substrate and having a multi-layered structure prepared by alternately laminating  
a ferromagnetic layer containing mainly cobalt and  
20 a nonmagnetic layer containing mainly ruthenium.

38. The perpendicular magnetic recording medium according to claim 37, wherein said ferromagnetic layer further contains at least one of chromium and a combination of platinum and chromium.

25 39. The perpendicular magnetic recording medium according to claim 38, wherein said ferromagnetic layer further contains platinum and oxygen.

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